



**Jet Propulsion Laboratory**  
California Institute of Technology

**JPL / McMaster-Carr**

**Matt Heverly**

**7/28/2019**

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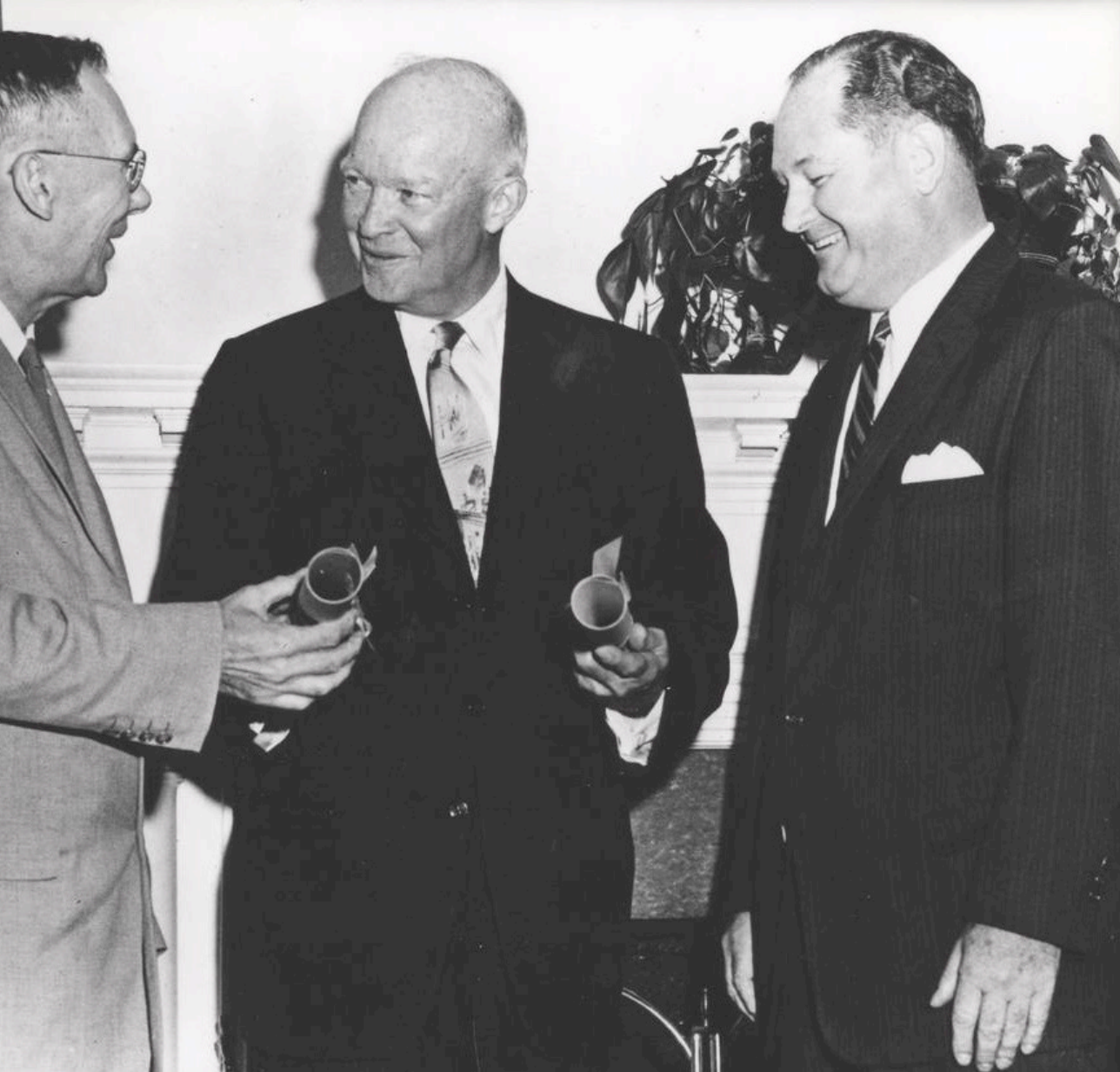
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Government sponsorship acknowledged.



**JPL** was founded in **1936** and in **1944** started building rockets for a military contract  
Private (bottom) and Corporal (top) rockets



**1958** Explorer 1 – first U.S. satellite



**1958** NASA created



**JPL** is one of 10 NASA center in the U.S. and is managed by **Caltech**



**Jet Propulsion Laboratory**  
California Institute of Technology



Our charter is robotic space and Earth **science** missions

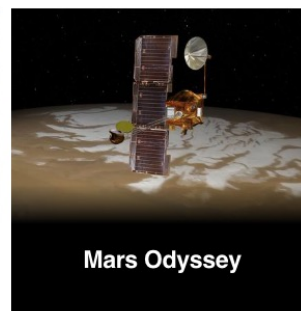
# 26 operational spacecraft, 1 rover, & 1 lander



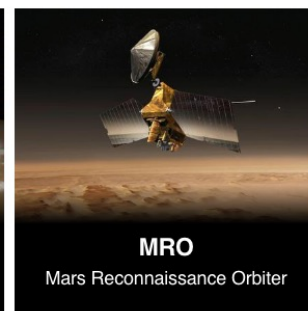
**Cloudsat**



**Juno**



**Mars Odyssey**



**MRO**  
Mars Reconnaissance Orbiter



**MIRO**  
Microwave Instrument for the  
Rosetta Orbiter



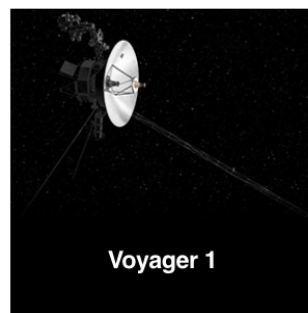
**NuSTAR**  
Nuclear Spectroscopic Telescope  
Array



**Jason 2**



**WISE**  
Wide-field Infrared Survey  
Explorer



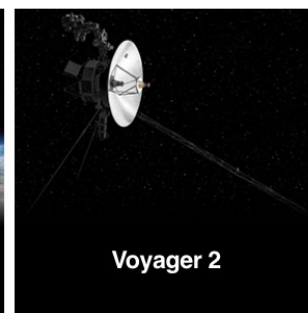
**Voyager 1**



**Spitzer Space Telescope**



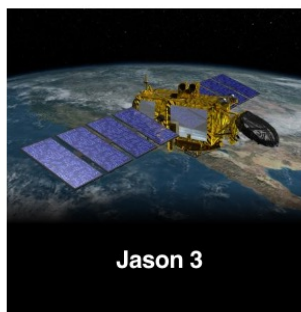
**OCO-2**  
Orbiting Carbon Observatory 2



**Voyager 2**



**SMAP**  
Soil Moisture Active Passive



**Jason 3**



**GRACE-FO**  
Gravity Recovery and Climate  
Experiment Follow-On



**NEOWISE**  
NEOWISE

# 26 operational spacecraft, 1 rover, & 1 lander



## **ASTERIA**

Arcsecond Space Telescope  
Enabling Research in  
Astrophysics



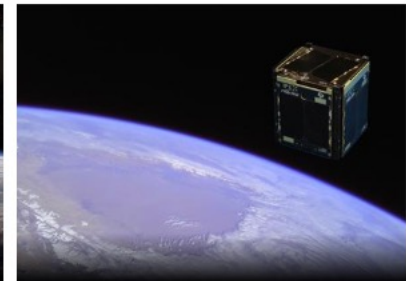
## **CubeRRT**

CubeSat Radiometer Radio  
Frequency Interference  
Technology Validation Mission



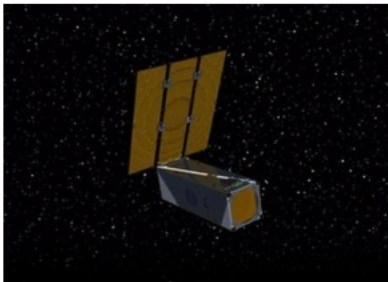
## **GRIFEX**

GEO-CAPE ROIC In-Flight  
Performance Experiment



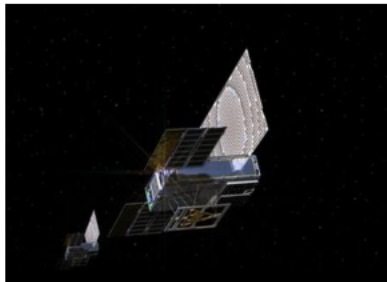
## **IPEX**

Intelligent Payload Experiment



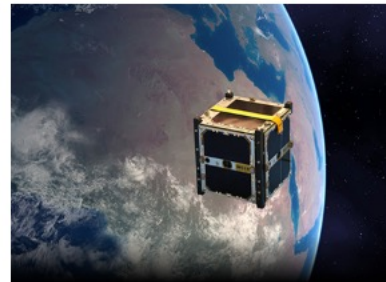
## **ISARA**

Integrated Solar Array and  
Reflectarray Antenna

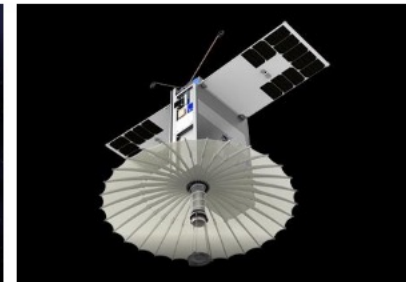


## **MarCO**

Mars Cube One



## **M-Cubed/COVE-2**



## **RainCube**

Radar in a CubeSat



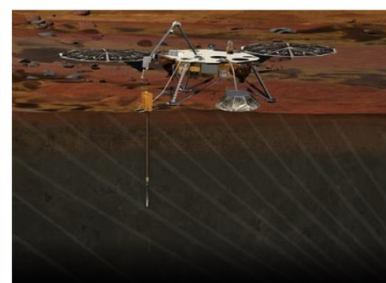
## **TEMPEST-D**

Temporal Experiment for Storms  
and Tropical Systems -  
Demonstration



## **MSL**

Mars Science Laboratory Curiosity  
Rover



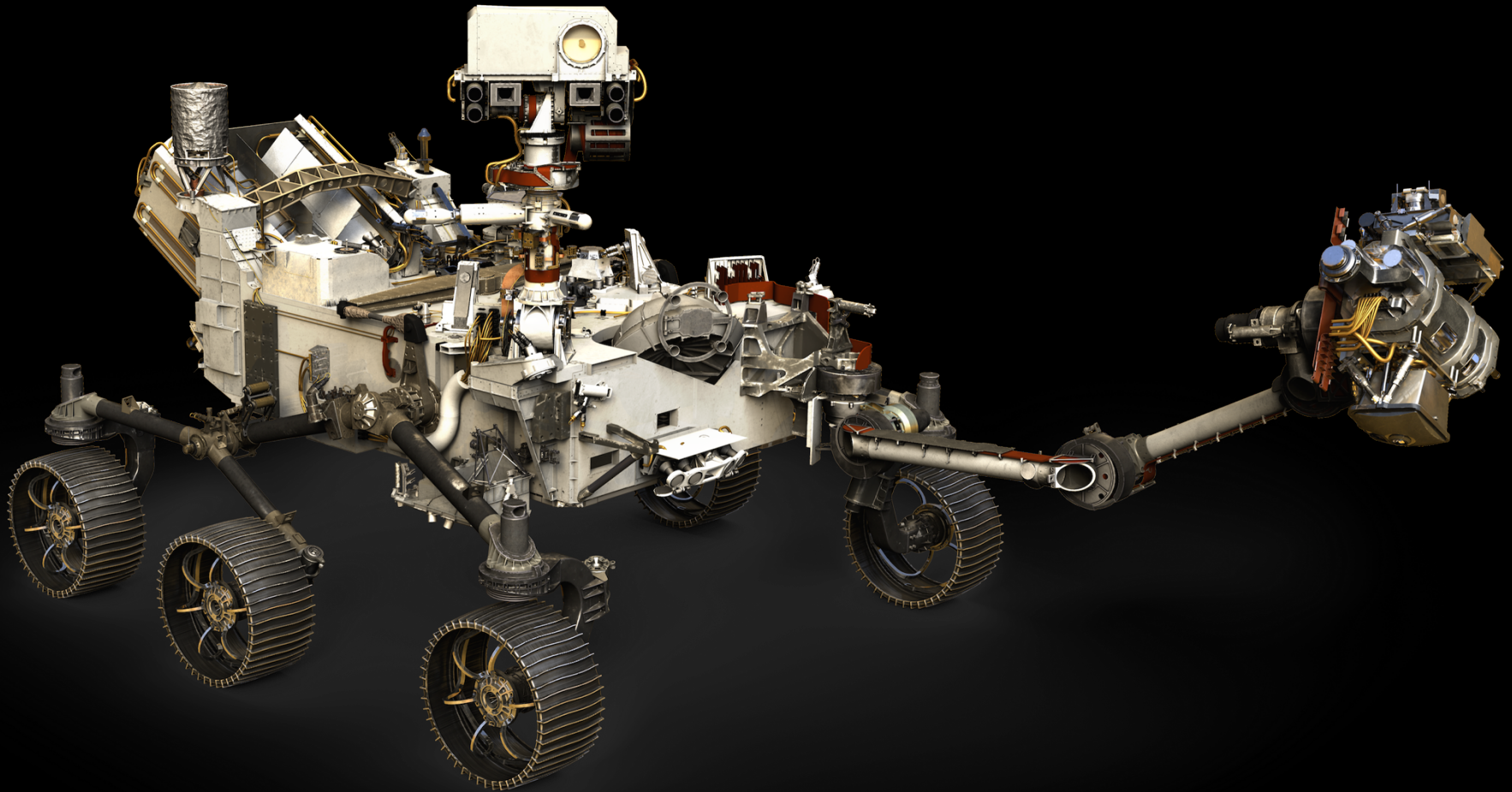
## **InSight**

# Mechanisms and Mobility

Charter: Design, development, and execution of world-class spacecraft mechanisms from "cradle to grave". Implementing planetary mobility systems and creating enabling technology.

# The Mars 2020 Rover:

## Seeking Signs of Past Life on Mars



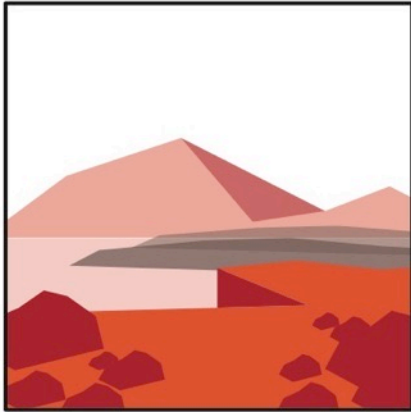
# Understanding the Possibilities for Life on Mars

Ancient Microbial Life

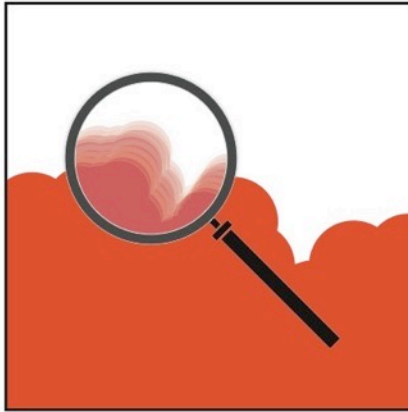


Human Life

**OBJECTIVE A:  
Geology**



**OBJECTIVE B:  
Astrobiology**

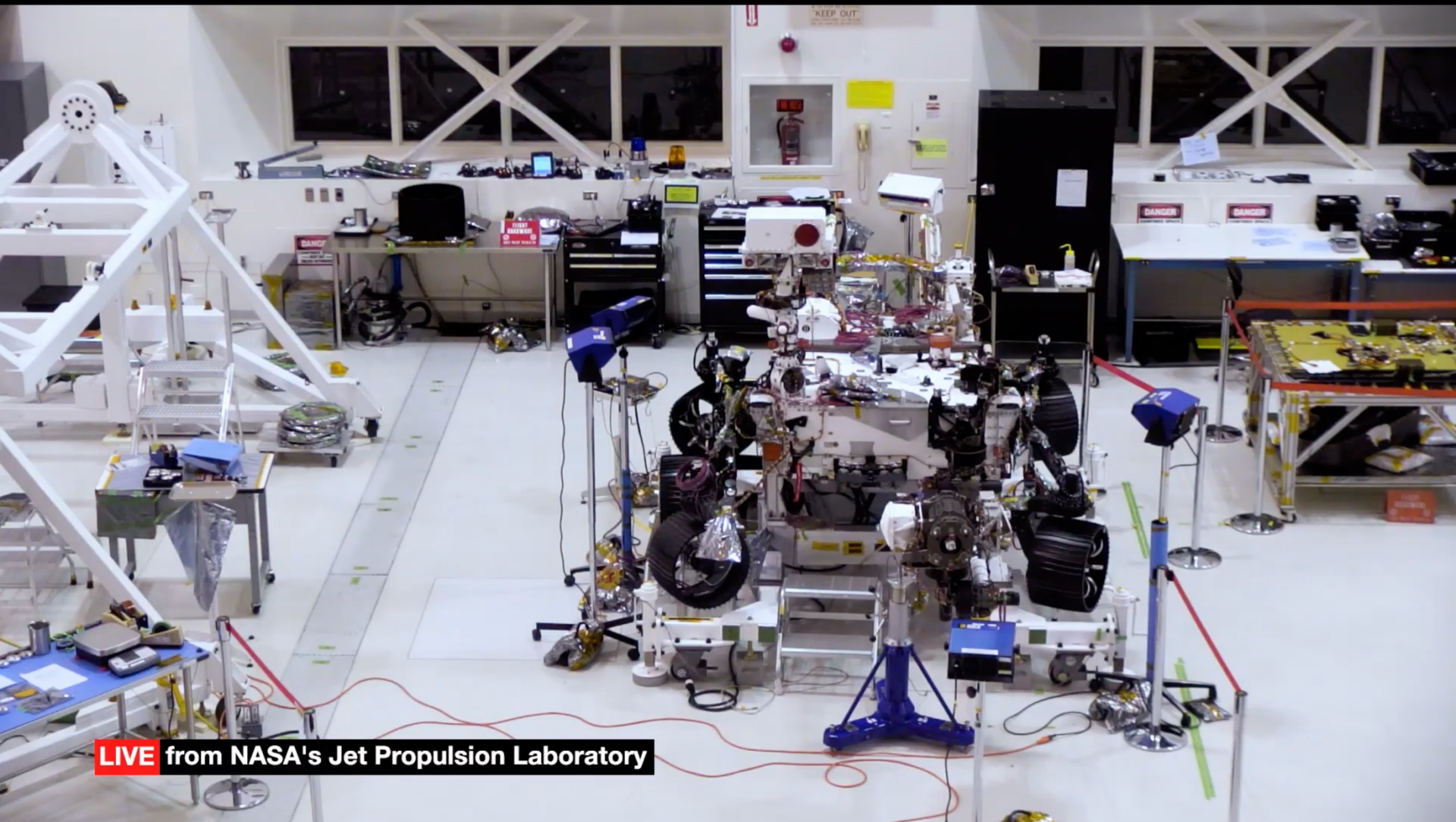


**OBJECTIVE C:  
Sampling**



**OBJECTIVE D:  
Prepare for Humans**





**LIVE** from NASA's Jet Propulsion Laboratory

**Launch Window:**  
July 17 - Aug. 5, 2020

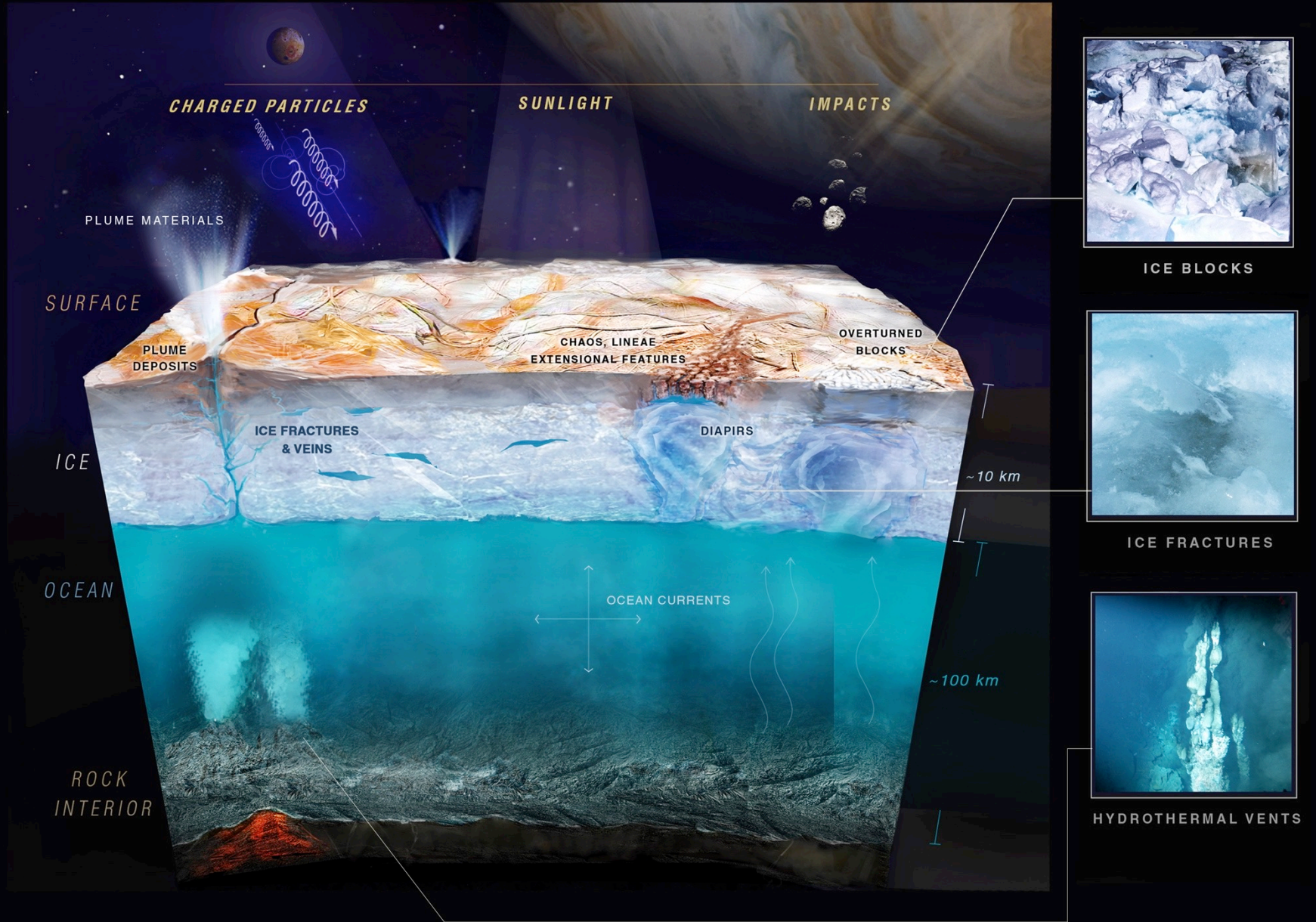
**Landing:**  
Feb. 18, 2021

# Potential Mars Sample Return

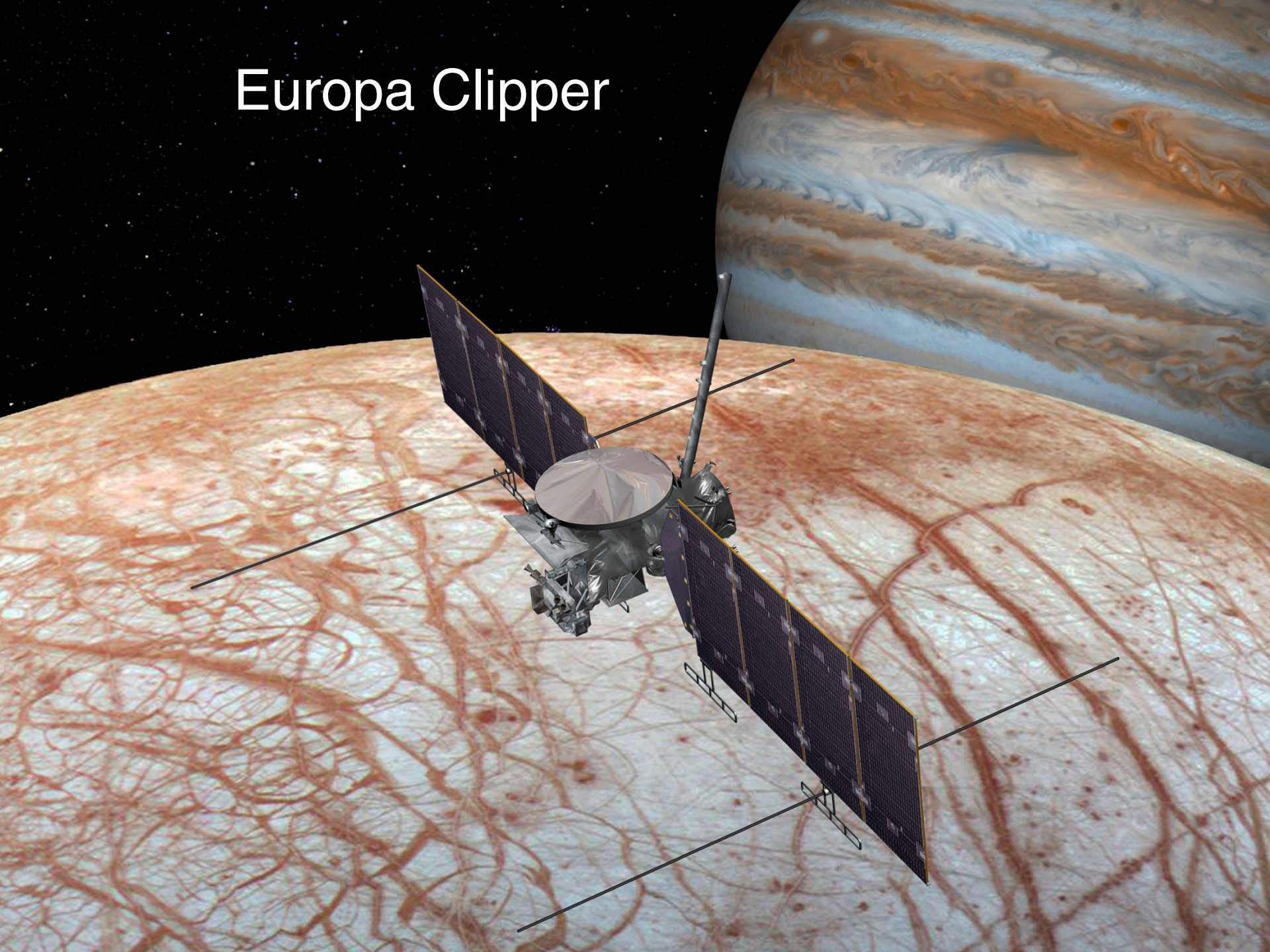


Pre-Decisional Information -- For Planning and Discussion Purposes Only

# EUROPA



# Europa Clipper



# Europa Lander Concept



Pre-Decisional Information -- For Planning and Discussion Purposes Only

# How We Use McMaster-Carr







## Project: Mars Sample Return Planning

Needed to build a proof-of-concept prototype for a mechanism review and had ~1.5 weeks to make it

Most off-the-shelf parts came from McMaster:

- Wave spring
- Plain shafts
- Keyed shafts and keys
- Bushings
- Threaded inserts
- Retaining rings
- Screws and washers



Prototype was successfully demonstrated at the review and helped communicate the design's functionality



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